

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (canceled)

1 Claim 2 (currently amended): The method of claim ~~[[1]]~~  
2 18 further comprising:  
3 ~~[[a)]~~ maintaining, using the first node, a first  
4 timer for tracking a send time interval, wherein the  
5 ~~[[acts]] act of [[composing the aggregated message~~  
6 ~~and]] sending the aggregated message [[are]] is~~  
7 performed after expiration of the first timer; and  
8 ~~[[e)]~~ restarting, using the first node, the first  
9 timer after the aggregated message is sent.

1 Claim 3 (previously presented): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time  
4 interval is less than the dead time interval.

1 Claim 4 (previously presented): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time  
4 interval is no more than one third of the dead time  
5 interval.

1 Claim 5 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than one second.

1 Claim 6 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than 100 msec.

1 Claim 7 (currently amended): The computer-implemented  
2 method of claim ~~[[1]]~~ 18 wherein the aggregated message  
3 further includes a dead time interval.

1 Claim 8 (currently amended): The computer-implemented  
2 method of claim ~~[[1]]~~ 18 wherein the act of sending the  
3 aggregated message includes providing the aggregated  
4 message in an Internet protocol packet.

1 Claim 9 (currently amended): The computer-implemented  
2 method of claim 8 wherein the aggregated message is sent  
3 ~~[[towards the neighbor node]]~~ by setting a destination  
4 address in the Internet protocol packet to a multicast  
5 address associated with routers that support aggregated  
6 interface forwarding liveness.

Claim 10 (canceled)

1 Claim 11 (currently amended): For use with a node, a  
2 computer-implemented method comprising:  
3 a) receiving, using the node, an aggregated message  
4 including, ~~[[1]]~~ for a first set of at least two  
5 different interfaces of a neighbor node, at least  
6 two indicators, each indicator identifying a  
7 different one of the at least two different  
8 interfaces of ~~[[a]]~~ the neighbor node and  
9 corresponding forwarding liveness status information  
10 for each of the at least two different interfaces of

11     the first set of the at least two different  
12     interfaces as data within the aggregated message[  
13     and  
14     ~~ii) a time interval]]~~; and  
15     b) updating, using the node, neighbor node  
16     forwarding liveness status information using the  
17     aggregated message,  
18     wherein the forwarding liveness status  
19     information includes an integrity and correct  
20     operation of a forwarding table of the neighbor  
21     node, and  
22     wherein the act of updating neighbor node  
23     forwarding liveness status information includes  
24     i) determining, by the node, whether the first  
25     set of at least two different interfaces is the  
26     same as a second set of at least two different  
27     interfaces of the neighbor node included in an  
28     earlier message,  
29     ii) if the first set of at least two different  
30     interfaces is determined to be the same as the  
31     second set of at least two different  
32     interfaces, then for each of the at least two  
33     different interfaces of both the first and  
34     second sets having a changed status, informing,  
35     by the node, a local interface of the changed  
36     status of its peer interface of the neighbor  
37     node, and  
38     iii) if the first set of at least two  
39     different interfaces is determined to be  
40     different from the second set of at least two  
41     different interfaces, then

42           A) for any interface in the first set but  
43           not in the second set, informing, by the  
44           node, a local interface of the status  
45           indicated in the aggregated message of its  
46           peer interface of the neighbor node, and  
47           B) for any interface in the second set  
48           but not in the first set, informing, by  
49           the node, a local interface that the  
50           status of its peer interface of the  
51           neighbor node is down.

1   Claim 12 (currently amended): The computer-implemented  
2   method of claim 11 wherein the aggregated message further  
3   includes a time interval and wherein the act of updating  
4   neighbor node liveness status information further  
5   includes

6           [[i+]] = setting a first timer to the time  
7           interval and starting the first timer,  
8           [[i+]] = if the first timer expires, setting a  
9           status of each of the at least two different  
10          interfaces of the neighbor node to down; and  
11          [[i+]] = if a further message, sourced from  
12          the neighbor node, and including

13          A) for a third set of at least two  
14          different interfaces, at least two  
15          indicators, each indicator identifying a  
16          different one of the at least two  
17          different interfaces of the neighbor node  
18          and corresponding forwarding liveness  
19          status information for each of the  
20          interfaces of the third set, and  
21          B) a new time interval,

22 is received then, resetting the first timer to  
23 the new time interval and restarting the first  
24 timer.

1 Claim 13 (previously presented): The  
2 computer-implemented method of claim 12 wherein each of  
3 the time interval and the new time interval is less than  
4 one second.

1 Claim 14 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information is interface  
4 forwarding liveness status information.

1 Claim 15 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 status information includes a forwarding liveness state  
4 selected from a group of forwarding liveness states  
5 consisting of (A) interface up, (B) interface down, (C)  
6 interface monitor not reporting, and (D) forwarding  
7 engine restarting.

1 Claim 16 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information further includes  
4 at least one of (i) the integrity and correct operation  
5 of switch fabric, (ii) the integrity and correct  
6 operation of a forwarding lookup engine, (iii) the  
7 integrity and correct operation of a traffic scheduler,  
8 (iv) the integrity and correct operation of a traffic  
9 classifier, (v) the integrity and correct operation of  
10 buffers in the data plane, (vi) the integrity and correct

11 operation of packet segmentation modules, (vii) the  
12 integrity and correct operation of packet reassembly  
13 modules, (viii) the integrity and correct operation of  
14 packet re-sequencing modules, (ix) whether or not a node  
15 is restarting, (x) whether or not the forwarding plane is  
16 congested, or (xi) the integrity and correct operation of  
17 fragmentation modules.

1 Claim 17 (currently amended): The computer-implemented  
2 method of claim 11 wherein the forwarding liveness status  
3 information further includes at least one of (i) bit  
4 error rate at a link interface, and (ii) clock  
5 synchronization at a link interface.

1 Claim 18 (currently amended): A computer-implemented  
2 method for monitoring interface forwarding liveness, the  
3 method comprising:  
4 a) determining, at a first node, forwarding  
5 liveness status information for a first set of at  
6 least two different interfaces of the first node;  
7 b) sending, from the first node, an aggregated  
8 message including, for the first set of at least two  
9 different interfaces, at least two indicators, each  
10 indicator identifying a different one of at least  
11 two different interfaces and the corresponding  
12 determined status information for the at least two  
13 different interfaces as data within the aggregated  
14 message;  
15 c) receiving, at the second node, the aggregated  
16 message; and

17 d) updating, by the second node, first node  
18 forwarding liveness status information using the  
19 aggregated message,  
20 wherein the forwarding liveness status  
21 information includes an integrity and correct  
22 operation of a forwarding table of the first node,  
23 and  
24 wherein the act of updating first node  
25 forwarding liveness status information includes  
26 i) determining, by the second node, whether  
27 the first set of at least two different  
28 interfaces of the first node is the same as a  
29 second set of at least two different interfaces  
30 of the first node included in an earlier  
31 message,  
32 ii) if the first set of at least two different  
33 interfaces is determined to be the same as the  
34 second set of at least two different  
35 interfaces, then for each of the at least two  
36 different interfaces of both the first and  
37 second sets having a changed status, informing,  
38 by the second node, a local interface of the  
39 changed status of its peer interface of the  
40 first node, and  
41 iii) if the first set of at least two  
42 different interfaces is determined to be  
43 different from the second set of at least two  
44 different interfaces, then  
45 A) for any interface in the first set but  
46 not in the second set, informing, by the  
47 second node, a local interface of the  
48 status indicated in the aggregated message

49                   of its peer interface of the first node,  
50                   and  
51                   B) for any interface in the second set  
52                   but not in the first set, informing, by  
53                   the second node, a local interface that  
54                   the status of its peer interface of the  
55                   first node is down.

1   Claim 19 (currently amended): The computer-implemented  
2   method of claim 18 wherein the aggregated message further  
3   includes a dead interval, and wherein the act of updating  
4   first node forwarding liveness status information further  
5   includes

6                   [[~~i~~]] = setting a timer to the dead interval;  
7                   [[~~ii~~]] = starting the timer;  
8                   [[~~iii~~]] = determining whether or not a further  
9                   message including forwarding liveness status  
10                  information is received from the first node  
11                  before the expiration of the timer; and  
12                  [[~~iv~~]] = if it is determined that a further  
13                  message including forwarding liveness status  
14                  information is not received from the first node  
15                  by the second node before the expiration of the  
16                  timer, then informing the second node that the  
17                  at least two different interfaces of the first  
18                  node are down.

1   Claim 20 (previously presented): The  
2   computer-implemented method of claim 18 wherein the  
3   status information includes a forwarding liveness state  
4   selected from a group of forwarding liveness states  
5   consisting of (A) interface up, (B) interface down, (C)



6 interface monitor not reporting, and (D) forwarding  
7 engine restarting.

1 Claim 21 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 forwarding liveness status information further includes  
4 at least one of (i) the integrity and correct operation  
5 of switch fabric, (ii) the integrity and correct  
6 operation of a forwarding lookup engine, (iii) the  
7 integrity and correct operation of a traffic scheduler,  
8 (iv) the integrity and correct operation of a traffic  
9 classifier, (v) the integrity and correct operation of  
10 buffers in the data plane, (vi) the integrity and correct  
11 operation of packet segmentation modules, (vii) the  
12 integrity and correct operation of packet reassembly  
13 modules, (viii) the integrity and correct operation of  
14 packet re-sequencing modules, (ix) whether or not a node  
15 is restarting, (x) whether or not the forwarding plane is  
16 congested, or (xi) the integrity and correct operation of  
17 fragmentation modules.

1 Claim 22 (previously presented): The  
2 computer-implemented method of claim 18 wherein the  
3 forwarding liveness status information includes at least  
4 one of (i) bit error rate at a link interface, and (ii)  
5 clock synchronization at a link interface.

Claims 23-29 (canceled)

1 Claim 30 (currently amended): The apparatus of claim  
2 ~~[[29]]~~ 46 further comprising:

3           [[iv+]] - maintaining a first timer for  
4           tracking a send time interval, wherein the act  
5           of ~~[[composing the aggregated message and]]~~  
6           sending the aggregated message composes  
7           ~~[[compose]]~~ and sends ~~[[send]]~~ the aggregated  
8           message after expiration of the first timer;  
9           and  
10          [[v+]] - restarting the first timer after the  
11          aggregated message is sent.

1   Claim 31 (previously presented): The apparatus of claim  
2   30 wherein the aggregated message further includes a dead  
3   time interval, and wherein the send time interval is less  
4   than the dead time interval.

1   Claim 32 (previously presented): The apparatus of claim  
2   30 wherein the aggregated message further includes a dead  
3   time interval, and wherein the send time interval is no  
4   more than one third of the dead time interval.

1   Claim 33 (previously presented): The apparatus of claim  
2   30 wherein the send time interval is less than one  
3   second.

1   Claim 34 (previously presented): The apparatus of claim  
2   30 wherein the send time interval is less than 100 msec.

1   Claim 35 (currently amended): The apparatus of claim  
2   ~~[[29]]~~ 46 wherein the aggregated message further includes  
3   a dead time interval.

1 Claim 36 (currently amended): The apparatus of claim  
2 ~~[[29]]~~ 46 wherein the act of sending the aggregated  
3 message includes providing the aggregated message in an  
4 Internet protocol packet.

1 Claim 37 (previously presented): The apparatus of claim  
2 36 wherein the act of sending the aggregated message  
3 includes setting a destination address in the Internet  
4 protocol packet to a multicast address associated with  
5 routers that support interface forwarding liveness.

Claim 38 (canceled)

1 Claim 39 (currently amended): ~~[[For use with a node,~~  
2 ~~apparatus]]~~ Apparatus comprising:  
3 a) one or more processors;  
4 b) at least one input device; and  
5 c) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a method  
8 of:  
9 i) receiving an aggregated message including,  
10 ~~[[A+]]~~ for a first set of at least two different  
11 interfaces of a neighbor node, at least two  
12 indicators, each indicator identifying a different  
13 one of the at least two different interfaces of  
14 ~~[[a]]~~ the neighbor node and corresponding forwarding  
15 liveness status information for the at least two  
16 different interfaces of the first set of the at  
17 least two different interfaces as data within the  
18 aggregated message~~[[, and~~  
19 ~~[[B) a time interval]]~~; and

20           ii) updating neighbor node forwarding liveness  
21 status information using the aggregated message,  
22 wherein the forwarding liveness status information  
23 includes an integrity and correct operation of a  
24 forwarding table of the neighbor node, and  
25           wherein the act of updating neighbor node  
26 forwarding liveness status information includes  
27           A) determining, by the node, whether the  
28 first set of at least two different  
29 interfaces is the same as a second set of  
30 at least two different interfaces of the  
31 neighbor node included in an earlier  
32 message,  
33           B) if the first set of at least two  
34 different interfaces is determined to be  
35 the same as the second set of at least two  
36 different interfaces, then for each of the  
37 at least two different interfaces of both  
38 the first and second sets having a changed  
39 status, informing, by the node, a local  
40 interface of the changed status of its  
41 peer interface of the neighbor node, and  
42           C) if the first set of at least two  
43 different interfaces is determined to be  
44 different from the second set of at least  
45 two different interfaces, then  
46           1) for any interface in the first  
47 set but not in the second set,  
48 informing, by the node, a local  
49 interface of the status indicated in  
50 the aggregated message of its peer  
51 interface of the neighbor node, and

52                   2) for any interface in the second  
53                   set but not in the first set,  
54                   informing, by the node, a local  
55                   interface that the status of its peer  
56                   interface of the neighbor node is  
57                   down.

1   Claim 40 (currently amended): The apparatus of claim 39  
2   wherein the aggregated message further includes a time  
3   interval and wherein the act of updating neighbor node  
4   liveness status information further includes  
5                   [[A+]] - setting a first timer to the time  
6                   interval and starting the first timer,  
7                   [[B+]] - setting a status of each of the  
8                   at least two different interfaces of the  
9                   neighbor node to down if the first timer  
10                   expires; and  
11                   [[C+]] - if a further message, sourced  
12                   from the neighbor node, and including  
13                   1) for a third set of at least two  
14                   different interfaces, at least two  
15                   indicators, each indicator  
16                   identifying a different one of the at  
17                   least two different interfaces of the  
18                   neighbor node and corresponding  
19                   forwarding liveness status  
20                   information for each of the  
21                   interfaces of the third set, and  
22                   2) a new time interval,  
23                   is received, resetting the first timer to  
24                   the new time interval and restarting the  
25                   first timer.

1 Claim 41 (previously presented): The apparatus of claim  
2 39 wherein each of the time interval and the new time  
3 interval is less than one second.

1 Claim 42 (previously presented): The apparatus of claim  
2 39 wherein the forwarding liveness status information is  
3 interface forwarding liveness status information.

1 Claim 43 (previously presented): The apparatus of claim  
2 39 wherein the status information includes a forwarding  
3 liveness state selected from a group of forwarding  
4 liveness states consisting of (A) interface up, (B)  
5 interface down, (C) interface monitor not reporting, and  
6 (D) forwarding engine restarting.

1 Claim 44 (previously presented): The apparatus of claim  
2 39 wherein the forwarding liveness status information  
3 further includes at least one of (i) the integrity and  
4 correct operation of switch fabric, (ii) the integrity  
5 and correct operation of a forwarding lookup engine,  
6 (iii) the integrity and correct operation of a traffic  
7 scheduler, (iv) the integrity and correct operation of a  
8 traffic classifier, (v) the integrity and correct  
9 operation of buffers in the data plane, (vi) the  
10 integrity and correct operation of packet segmentation  
11 modules, (vii) the integrity and correct operation of  
12 packet reassembly modules, (viii) the integrity and  
13 correct operation of packet re-sequencing modules, (ix)  
14 whether or not a node is restarting, (x) whether or not  
15 the forwarding plane is congested, or (xi) the integrity  
16 and correct operation of fragmentation modules.

1 Claim 45 (currently amended): The apparatus of claim 39  
2 wherein the forwarding liveness status information  
3 further includes at least one of (i) bit error rate at a  
4 link interface, and (ii) clock synchronization at a link  
5 interface.

1 Claim 46 (currently amended): A system comprising:  
2 a) a first node including  
3 i) one or more processors;  
4 ii) at least one input device; and  
5 iii) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a  
8 method of:  
9 A) determining, at ~~[[a]]~~ the first node,  
10 forwarding liveness status information for  
11 a first set of at least two different  
12 interfaces of the first node, and  
13 B) sending, from the first node, an  
14 aggregated message including, for the  
15 first set of at least two different  
16 interfaces, at least two indicators, each  
17 indicator identifying a different one of  
18 at least two different interfaces and the  
19 corresponding determined status  
20 information for the at least two different  
21 interfaces as data within the aggregated  
22 message,  
23 wherein the forwarding liveness  
24 status information includes an integrity  
25 and correct operation of a forwarding  
26 table of the first node; and

27       b). a second node including  
28           i) one or more processors;  
29           ii) at least one input device; and  
30           iii) one or more storage devices storing  
31           processor-executable instructions which, when  
32           executed by one or more processors, perform a  
33           method of:  
34           A) receiving, at the second node, the  
35           aggregated message sent by the first node,  
36           and  
37           B) updating first node forwarding  
38           liveness status information using the  
39           aggregated message,  
40           wherein the act of updating first  
41           node forwarding liveness status  
42           information includes  
43           1) determining, by the second node,  
44           whether the first set of at least two  
45           different interfaces is the same as a  
46           second set of at least two different  
47           interfaces of the first node included  
48           in an earlier message,  
49           2) if the first set of at least two  
50           different interfaces is determined to  
51           be the same as the second set of at  
52           least two different interfaces, then  
53           for each of the at least two  
54           different interfaces of both the  
55           first and second sets having a  
56           changed status, informing, by the  
57           second node, a local interface of the



58 changed status of its peer interface  
59 of the first node, and  
60 3) if the first set of at least two  
61 different interfaces is determined to  
62 be different from the second set of  
63 at least two different interfaces,  
64 then  
65 (a) for any interface in the  
66 first set but not in the second  
67 set, informing, by the second  
68 node, a local interface of the  
69 status indicated in the  
70 aggregated message of its peer  
71 interface of the first node, and  
72 (b) for any interface in the  
73 second set but not in the first  
74 set, informing, by the second  
75 node, a local interface that the  
76 status of its peer interface of  
77 the first node is down.

1 Claim 47 (currently amended): The system of claim 46  
2 wherein the aggregated message further includes a dead  
3 interval, and wherein the act of updating first node  
4 forwarding liveness status information further includes  
5 [[i+]] - setting a timer to the dead interval;  
6 [[ii+]] - starting the timer;  
7 [[iii+]] - determining whether or not a further  
8 message including forwarding liveness status  
9 information is received from the first node  
10 before the expiration of the timer; and

11           ~~[[iii]]~~ - informing the second node that the  
12           at least two different interfaces of the first  
13           node are down if it is determined that a  
14           further message including forwarding liveness  
15           status information is not received from the  
16           first node by the second node before the  
17           expiration of the timer.

1   Claim 48 (previously presented): The system of claim 46  
2   wherein the status information includes a forwarding  
3   liveness state selected from a group of forwarding  
4   liveness states consisting of (A) interface up, (B)  
5   interface down, (C) interface monitor not reporting, and  
6   (D) forwarding engine restarting.

1   Claim 49 (previously presented): The system of claim 46  
2   wherein the forwarding liveness status information  
3   further includes at least one of (i) the integrity and  
4   correct operation of switch fabric, (ii) the integrity  
5   and correct operation of a forwarding lookup engine,  
6   (iii) the integrity and correct operation of a traffic  
7   scheduler, (iv) the integrity and correct operation of a  
8   traffic classifier, (v) the integrity and correct  
9   operation of buffers in the data plane, (vi) the  
10   integrity and correct operation of packet segmentation  
11   modules, (vii) the integrity and correct operation of  
12   packet reassembly modules, (viii) the integrity and  
13   correct operation of packet re-sequencing modules, (ix)  
14   whether or not a node is restarting, (x) whether or not  
15   the forwarding plane is congested, or (xi) the integrity  
16   and correct operation of fragmentation modules.

1 Claim 50 (original): The system of claim 46 wherein the  
2 forwarding liveness status information includes at least  
3 one of (i) bit error rate at a link interface, and (ii)  
4 clock synchronization at a link interface.

1 Claim 51 (currently amended): The computer-implemented  
2 method of claim ~~[[1]]~~ 18 wherein the forwarding liveness  
3 status information of at least one of the at least two  
4 different interfaces included in the aggregated message  
5 includes a forwarding liveness state set to interface  
6 monitor not reporting.

1 Claim 52 (currently amended): The computer-implemented  
2 method of claim ~~[[1]]~~ 18 wherein the forwarding liveness  
3 status information of at least one of the at least two  
4 different interfaces included in the aggregated message  
5 includes a forwarding liveness state set to forwarding  
6 engine restarting.

1 Claim 53 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information of at least one of  
4 the at least two different interfaces included in the  
5 first set of at least two different interfaces included  
6 within the aggregated message includes a forwarding  
7 liveness state set to interface monitor not reporting.

1 Claim 54 (previously presented): The  
2 computer-implemented method of claim 11 wherein the  
3 forwarding liveness status information of at least one of  
4 the at least two different interfaces included in the  
5 first set of at least two different interfaces included

- 6 within the aggregated message includes a forwarding
- 7 liveness state set to forwarding engine restarting.